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EXAMINER

MUNOZ, GUILLERMO

| ART UNIT | PAPER NUMBER |
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2637

DATE MAILED: 03/28/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/024,120

Applicant(s)

KLIMOVITCH, GLEB V.

Examiner

Guillermo Munoz

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 December 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-34 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-14, 19 and 21-34 is/are rejected.
- 7) ☒ Claim(s) 15-18, 20 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 09/23/02.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

Claims 3, 10, 14, 17, 19, 21, 26-32 are objected to because of the following informalities:

Regarding claim 3, the term “substantially” in line 2 should be deleted.

Regarding claim 10, the variable “k” is critical or essential to the practice of the invention, but is not defined in the claim.

Regarding claim 14, the term “characteristics” in line 2 should be changed to — characteristic—.

Regarding claim 17, the variables “Ntxblocks”, “t”, “m”, “k”, “Nblock” and “ x_{chirp} ” are critical or essential to the practice of the invention, but is not defined in the claim.

Regarding claim 19, the variables “Tblock”, “p”, “q”, “k”, “ α ”, and “Lblock” are critical or essential to the practice of the invention, but is not defined in the claim.

Regarding claim 21, the acronym “MIMO” is critical or essential to the practice of the invention, and should be written in long form.

Claim 26 appears to be a preamble claim without a claim body. The claim should be rewritten in such a way as to differentiate the body of the claim from the preamble. In addition, a goal to “a data transmission system” is set forth in the preamble. However, the claim does not recite any structure or component(s) associated with the “data transmission system”.

The same comment applies to claims 27-29.

Regarding claim 30, the term “and local oscillators” in line 2 should be deleted.

Regarding claim 31, the claim appears to claim limitations of a transmitter, however, the claimed subject matter is a receiver.

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Regarding claim 32, the claim appears to claim limitations of a receiver, however, the claimed subject matter is a transmitter.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 7 recites the limitation "said blocks" in line 1. There is insufficient antecedent basis for this limitation in the claim.

Claims 8-10 are dependent on rejected claim 7, and are rejected under 35 U.S.C. 112, second paragraph.

Claim 19 recites the limitation "Tblock" in line 1. There is insufficient antecedent basis for this limitation in the claim.

Claim 21 recites the limitation "said second plurality of antennas" in line 6. There is insufficient antecedent basis for this limitation in the claim.

Claim 22 is dependent on rejected claim 21, and are rejected under 35 U.S.C. 112, second paragraph.

Claims 26, 28, and 29 are rejected as failing to define the invention in the manner required by 35 U.S.C. 112, second paragraph. The claim(s) are narrative in form and do not contain positively recited steps of a specific process. Note that method claims should set forth a series of steps in the active tense in an instruction-like manner thereby reciting an actual method.

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Claim 30 is rejected as failing to define the invention in the manner required by 35 U.S.C. 112, second paragraph. The claim(s) are narrative in form and replete with indefinite and functional or operational language. The structure which goes to make up the device must be clearly and positively specified. The structure must be organized and correlated in such a manner as to present a complete operative device. The claim(s) must be in one sentence form only. Note the format of the claims in the patent(s) cited.

Regarding claim 34, the term “and/or” in line 5 renders the claim indefinite for failing to clearly point out the structural composition of the processing stage.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claim 26 is rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. The claim, when taken as a whole, merely manipulate an abstract idea (a set of orthogonal signals). A claim to an abstract idea however, falls outside the four statutory classes of inventions, namely process, machines, manufacture and composition of matters. USPTO on Computer Related Invention Guidelines provides that for a claim including such a subject matter be statutory, the claimed process must be limited to a practical application in the technological arts. The claims however do not definitively include any limitation to a practical application in the technological arts. For instance, lets consider, “a set of orthogonal signals” which is merely “a set of signals alone”. A set of signals alone are nonstatutory subject matter unless there is a limitation to a practical application in the technological arts. The claimed

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“signals” maintain a characteristic under certain conditions; however, the conditions are not definitively recited as a limitation. Since the claim fail to satisfy such a requirement, it is determined to be non-compliant with 35 USC 101 requirements and therefore non-statutory..

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 23-25 are rejected under 35 U.S.C. 102(e) as being anticipated by Hudson.

Regarding claim 23, Hudson illustrates estimating a frequency domain channel response in element 290 of figure 2. Hudson teach spectral equalization in the frequency domain yields a time-domain equalized packet spectrum that can be converted back into the time domain by an IFFT process. Hudson teach the time domain impulse response equalizer require taps having corresponding coefficients and truncating the number of taps, thereby truncating the number of coefficients, would reduce the computational burden of the equalizer, note paragraph 0011. Hudson illustrates the corrected impulse response is used to correct the next symbol packet prior to FFT processing, note paragraph 0054.

Regarding claim 24; as applied to claim 23, Hudson further teach the claimed subject matter in figure 2 element 212.

Regarding claim 25; as applied to claim 23, Hudson further teach the claimed subject matter in figure 2 element 294.

Claims 31-33 are rejected under 35 U.S.C. 102(e) as being anticipated by Ma et al.

Regarding claim 31, Ma et al. disclose a Multiple-Input-Multiple-Output OFDM communications system which teach all the claimed subject matter as follows.

Ma et al. teach an IF amplifier, mixers, power amplifiers, bandpass filters and a local oscillator in paragraph 0029. Ma et al. disclose that MIMO systems comprise multiple transmit and receive antennas in paragraph 0005. Ma et al. teach the claimed I/Q modulator by inherency of the I/Q system illustrated in figure 5.

Regarding claim 32, Ma et al. disclose a Multiple-Input-Multiple-Output OFDM communications system which teach all the claimed subject matter as follows.

Ma et al. teach an LNA amplifier, mixers, gain amplifiers, bandpass filters and a local oscillator in paragraph 0030. Ma et al. disclose that MIMO systems comprise multiple transmit and receive antennas in paragraph 0005. Ma et al. teach the claimed I/Q demodulator in figure 5 elements 70 and 75.

Regarding claim 33, Ma et al. disclose a Multiple-Input-Multiple-Output OFDM communications system which teach all the claimed subject matter as follows.

Ma et al. teach: "a generator of chirp sequences" (Ma et al. does not explicitly state chirp sequences, however, the functionality of elements 45 and 50 in figure 3 is the same.);

"a cyclic prefix adder" (Ma et al. illustrates the claimed subject matter in figure 1 elementn 400.);

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“a phase rotator” (Ma et al. does not explicitly state phase rotator, however the operation of element 300 in figure 1 includes the same function).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-3, 11-14, 21-22, 26-30, and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Raleigh et al. and Ma et al..

Regarding claim 34, Raleigh et al. disclose a communications system which teach almost all the claimed subject matter as follows. Raleigh et al. teach:

“a plurality of transmitters” (Raleigh et al. illustrates a plurality of transmitters in figure 6 elements 152a and 152b.);

“a plurality of receivers” (Raleigh et al. illustrates a plurality of receivers in figure 6 elements 170a and 170b.);

“a plurality of transmit and receive antennas” (Raleigh et al. illustrates a plurality of transmit and receive antennas in figure 6 elements 55.);

“digital signal processing...for channel estimate” (Raleigh et al. illustrates the digital signal processing for channel estimation in figure 1 elements 10 and 20.);

“by using the redundancy in the received training signals” (The training signals are injected periodically in time, frequency, or time and frequency, note col. 6 lines 6-20).

“by transform-based techniques in both frequency and spatial domains” (Raleigh et al. illustrates the claimed subject matter in figure 3 element 140.);

“disentangles the signals arriving from different transmitters” (Raleigh et al. teach the disentangles the signals arriving from different transmitters by the inherency of the channel estimations used to aid in demodulation and decoding of the data sequence, note col. 6 lines 6-20.);

Raleigh et al. teach a timing and frequency synchronization apparatus used to recover the timing of the transmitted digital signal sequence after digitization using any of several know techniques known in the art. However, Raleigh et al. does not disclose the details of the timing and frequency synchronization apparatus.

Ma et al. teach a system for synchronization in a MIMO-OFDM system, which teach training symbol estimations are used to correct for frequency offset and phase noise, note paragraph 0044-0049.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention to implement Raleigh et al.’s synchronization system with Ma et al.’s synchronization system, since Ma et al. suggest in paragraph 0007 the synchronization method would improve synchronization within an OFDM-MIMO system.

Regarding claim 1; as applied to claim 34, Raleigh et al. further teach the claimed subject matter as follows.

Raleigh et al. teach a combined OFDM-MIMO (MOFDM) communications system, note col. 14, lines 1-11. Raleigh et al. teach transmitting a plurality of training signals within the MOFDM system, note col. 6, lines 6-20.

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Claim 1 recites comparing said transmitted training sequence signals with said received training sequence signals. It is interpreted by examiner that the claimed compares a replica of the transmitted training sequence, rather than the actual transmitted sequence.

Raleigh et al. teach estimating channel parameters based on the received training sequence, note col. 6, lines 6-20.

It would have been within the level of one having ordinary skill in the art at the time of the invention to characterize the channel estimation based on a training sequence as a comparison of the received training sequence and an ideal replica of the transmitted sequence.

Regarding claim 2; as applied to claim 1 above, Raleigh et al. further teach the claimed subject matter, note col. 34, lines 10-24.

Regarding claim 3; as applied to claim 1 above, Raleigh et al. teach the claimed subject matter by the inherency of the transmission using a OFDM-MIMO system.

Regarding claim 11; as applied to claim 1 above, Raleigh et al. teach a timing and frequency synchronization apparatus used to recover the timing of the transmitted digital signal sequence after digitization using any of several know techniques known in the art. However, Raleigh et al. does not disclose the details of the timing and frequency synchronization apparatus.

Ma et al. teach a system for synchronization in a MIMO-OFDM system, which teach training symbol estimations of two successive training symbols are used to correct for frequency offset and phase noise, note paragraph 0048.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention to implement Raleigh et al.'s synchronization system with Ma et al.'s

synchronization system, since Ma et al. suggest in paragraph 0007 the synchronization method would improve synchronization within an OFDM-MIMO system.

Regarding claim 12; as applied to claim 1, Raleigh et al. teach a timing and frequency synchronization apparatus used to recover the timing of the transmitted digital signal sequence after digitization using any of several known techniques known in the art. However, Raleigh et al. does not disclose the details of the timing and frequency synchronization apparatus.

Ma et al. teach a system for synchronization in a MIMO-OFDM system, which teach the synchronization system would have improved performance over existing synchronization methods, note paragraph 0007.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention to implement Raleigh et al.'s synchronization system with Ma et al.'s synchronization system, since Ma et al. suggest in paragraph 0007 the synchronization method would improve synchronization within an OFDM-MIMO system.

Regarding claim 13, Raleigh et al. further teach the claimed subject matter, note col. 30 lines 19-41.

Regarding claim 14, Raleigh et al. further teach the claimed subject matter, col. 31 lines 48-55.

Regarding claim 21, see claim 34.

Regarding claim 22, see claim 34.

Regarding claim 26; as applied in claim 34, Raleigh et al. disclose a Multiple-Input-Multiple-Output OFDM communications system which teach all the claimed subject matter, note col.4 lines 60-67.

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Regarding claim 27; as applied in claim 34, Raleigh et al. disclose a Multiple-Input-Multiple-Output OFDM communications system which teach all the claimed subject matter, note col. 8 lines 11-27.

Regarding claim 28; as applied in claim 34, Raleigh et al. disclose a Multiple-Input-Multiple-Output OFDM communications system which teach all the claimed subject matter, note col. 8 lines 11-27.

Regarding claim 29; as applied in claim 34, Raleigh et al. disclose a Multiple-Input-Multiple-Output OFDM communications system which teach all the claimed subject matter, note col. 18 lines 64-68.

Regarding claim 30; as applied in claim 34, Raleigh et al. disclose a Multiple-Input-Multiple-Output OFDM communications system which teach all the claimed subject matter, note col. 7, lines 55-65.

Claims 4-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Raleigh et al. and Ma et al. and Tarokh et al. "Space-Time Coded OFDM for High Data-Rate Wireless Communication Over Wideband Channels".

Regarding claim 4; as applied to claim 1, Raleigh et al. disclose training symbols transmitted over an OFDM-MIMO system for channel estimation, however, Raleigh et al. does not disclose the training sequence signals having equal power spectral density in frequency and time.

Tarokh et al. teach an OFDM-MIMO system, wherein transmission from different antennas occurs simultaneously, note System Model section on pages 2232-2233. Tarokh et al.

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explains that these signals are assumed to have equal average power, note Simulation Results on page 2233.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention to describe the training symbols of Raleigh et al. with Tarokh et al.'s characterization of having an equal average power.

Regarding claim 5; as applied to claim 4 above, Raleigh et al. teach a timing and frequency synchronization apparatus used to recover the timing of the transmitted digital signal sequence after digitization using any of several known techniques known in the art. However, Raleigh et al. does not disclose the details of the timing and frequency synchronization apparatus.

Ma et al. teach a system for synchronization in a MIMO-OFDM system, which teach PN sequence. Ma et al. does not explicitly state chirp sequences, however, the functionality of elements 45 and 50 in figure 3 is the same.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention to implement Raleigh et al.'s synchronization system with Ma et al.'s synchronization system, since Ma et al. suggest in paragraph 0007 the synchronization method would improve synchronization within an OFDM-MIMO system.

Regarding claim 6; as applied to claim 4 above, Raleigh et al. further illustrate the claimed subject matter in figure 10 element 206.

Regarding claim 7; as applied to claim 5, Raleigh et al. disclose training symbols transmitted over an OFDM-MIMO system for channel estimation, however, Raleigh et al. does not disclose the blocks equaling the number of transmit antennas.

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Tarokh et al. teach an OFDM-MIMO system, wherein transmission from different antennas occurs simultaneously, note System Model section on pages 2232-2233. Tarokh et al. explains that number of blocks equal the number of transmit antennas, note Simulation Results on page 2233.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention to describe the transmitted signal of Raleigh et al. with Tarokh et al.'s characterization of having an equal number of blocks and transmitting antennas.

Allowable Subject Matter

The following is a statement of reasons for the indication of allowable subject matter:

Claims 8-10 are considered allowable because the present invention comprises a method for communication over an OFDM-MIMO communications system wherein the transmitted training sequence signals in each block have a different phase. The closest art, Tarokh et al. (Space-Time Coded OFDM for High Data-Rate Wireless Communication Over Wideband Channels) shows a similar circuit including a method for transmitting over an OFDM-MIMO communications system. However, Tarokh et al.'s fails to teach the transmitted training sequence of each block having a different phase. Claims 9-10 include the limitation and would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

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Claims 15-20 are considered allowable because the present invention comprises a method for communication over an OFDM-MIMO communications system wherein an estimation of a phase difference between each received subsequence is performed using a partial subsequence-based phase difference estimation process. The closest art, Raleigh et al. (US 6,452,981 B1) shows a similar circuit including a method for transmitting over an OFDM-MIMO communications system. However, Raleigh et al. fails to teach using a partial subsequence-based phase difference to estimate the phase difference between each received subsequence. Claims 16-20 include the limitation and would be allowable if rewritten to include all of the limitations of the base claim and any intervening claims.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."


Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Guillermo Munoz whose telephone number is 571-272-3045. The examiner can normally be reached on Monday-Friday 8:30a.m-4:30p.m..

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jay Patel can be reached on 571-272-2988. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


GM
March 14, 2005


JEAN B. CORRIELUS
PRIMARY EXAMINER

3/21/05